Title: Reaction Time

Purpose: To calculate individual reaction time in normal lab conditions.

Background Information:
Human error is a part of most high school lab experiments. It takes some time for us to react to different stimuli and trigger different parts of the experiment or timers to stop gathering data. Reaction time is usually less than a second, and it is really difficult to use a timer to accurately determine it, so using kinematics equations and knowing that the acceleration due to gravity near the surface of the earth is 9.8 m/s\(^2\), we can determine reaction time from how much a meter stick is displaced before we can catch it.

Materials:
- Meter stick
- Partner
- Access to a computer to use the reaction time game: (for comparison) www.bbc.co.uk/science/humanbody/sleep/sheep/reaction_version5.swf

Procedure:
One student should hold the meter stick so that it is hanging vertically. The other student should begin with his/her hand lined up at the 20 cm mark. The first student should drop the meter stick at a random time and the second student should catch it as soon as possible. Record the displacement of the ruler. Repeat for 5 trials and find the average.

Data:

<table>
<thead>
<tr>
<th>Trial</th>
<th>Change in position (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.17</td>
</tr>
<tr>
<td>2</td>
<td>0.22</td>
</tr>
<tr>
<td>3</td>
<td>0.18</td>
</tr>
<tr>
<td>4</td>
<td>0.18</td>
</tr>
<tr>
<td>5</td>
<td>0.21</td>
</tr>
</tbody>
</table>

Average: 0.192

Results/Calculations:
Using the equation:

\[ y = y_0 + v_{y0} t + \frac{1}{2} at^2 \]

\[ y_0 = 0 \text{ m} \]
\[ v_0 = 0 \text{ m/s} \]

\[ \Delta y = \frac{1}{2} at^2 \]

Average displacement of 0.192 m yields a reaction time of 0.198 seconds

\[ t = \sqrt{\frac{2\Delta y}{g}} \]
**Error Analysis:**

When I found my reaction time with the online sheep game, I had an average of 0.268 seconds. This yields a 28.4% error.

Several sources of error in the calculations of this lab may be due to the differing levels of distraction while the lab was being performed. We also rounded to the nearest centimeter when taking measurements for the displacement.

The sheep game is not an accurate comparison in reaction, time since the stimuli and conditions are different. Different tasks have different neural pathways there for yield different reaction times. The purpose for this lab was to just get a measurement to use as a comparison for the error analysis section.

**Conclusion:**

During this lab exercise, we found a way of measuring reaction time with a displacement instead of a stop watch. Using our knowledge of kinematics and the assumption that the acceleration due to gravity is 9.8 m/s^2, we were able to rearrange the equations such that reaction time was equal to $\sqrt{\frac{2\Delta y}{g}}$. After ten trials, my average displacement was 0.192 meters, which yielded a reaction time of 0.198 seconds.

Overall, a reaction time of 0.198 seconds is not bad. There was a relatively large percent error when compared to the sheep game reaction time, however these are two different situations and they test reaction time to different stimuli.

The information we learned in this lab will help us with our discussion of error in the future. We can factor in our average reaction time into error calculations in the future.

In the future, if I were to repeat this lab experiment, I would try to make sure I lined up the top of my fingers to the 20 cm mark and rounded to the nearest millimeter instead of centimeter. I would also try to control the level of noise and distractions.